

REMARKS

The instant Office Action dated April 3, 2009 listed the following rejections: claims 1-3 and 5-10 stand rejected under 35 U.S.C. § 103(a) over Nakagawa *et al.* (US Patent No. 6,452,231); and claim 4 stands rejected under 35 U.S.C. § 103(a) over Nakagawa in view of Hueting *et al.* (U.S. Patent No. 6,534,823). Claims 13-14 are allowed, and claims 11-12 would be allowable if rewritten in independent form. Applicant respectfully traverses all rejections, and further does not acquiesce to any averment made in the Office Action, unless Applicant explicitly states otherwise.

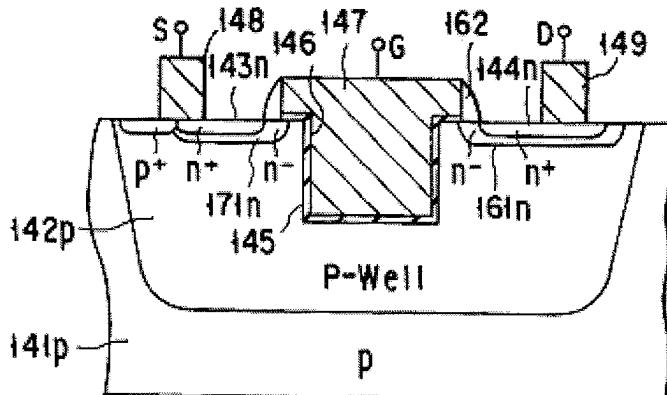
Claims 11-12 now include the underlying aspects of claim 1. This should remove the objection and isolate claims 1-10 for the discussion below and any necessary appeal.

Regarding the 35 U.S.C. § 103(a) rejection of claims 1-3 and 5-10 over the '231 reference (and as applicable to the rejection of claim 4), the Office Action has mistakenly characterized various cited portions of the '231 reference, which do not correspond to the claimed invention as asserted, and has failed to show correspondence to multiple limitations including, for example, limitations directed to "insulated gate trench including a gate conductor insulated from the source and drain implantations and the body region by a gate dielectric along the side and end walls and the base of the trench" (e.g., as in claim 1). In short, the alleged trench region in the '231 reference does not extend into a source or drain region, or into a source or drain contact region, and correspondingly does not have a gate conductor insulated from the source and drain by a dielectric along sidewalls and endwalls of the dielectric.

In the Final Office Action, the Examiner erroneously alleges that Nakagawa (e.g., Figure 48A, reproduced below) discloses its source 171n and drain 161n as extending along a part of the side walls of the trench because they extend down and away relative to a portion of the gate 147. This downward extension does not equate to the claimed "source and drain implantations extending along part of the side walls of the trench." With regards to the Examiner's note that Applicant's argument relies on unclaimed features (i.e., the trench extends into the source and drain regions) are not recited in the rejected claim(s), Applicant would refer the Examiner a closer reading of the independent claims including, e.g., the lower portions of claim 1 and particularly lines 13-14 thereof.

As indicated in the previous Response, these differences are illustrated in FIG. 48b from the '231 reference (copied below). The cited gate trench 145 stops far short of the source/drain regions 143n/144n, and from the offset layers 171n/171n.

FIG. 48B



As shown in FIG. 48B, the gate 147 has a "T" shape such that the upper portion extends over the substrate and is insulated therefrom by an underlying gate dielectric. The portions of the gate 147 that are buried in the substrate are isolated by the sidewall/dielectric 145, but are spaced from and do not extend into the source and drain regions. This is apparently reflected in the Office Action's lack of citation to any reference in connection with the asserted teachings of "the source and drain implantations extending along part of the side walls of the trench" at page 3. Moreover, the Office Action has erroneously alleged that regions 143n and 144n are "shallow contact regions," where these regions are the actual source and drain regions themselves (e.g., Col. 15:3-12), with contacts 148 and 149 being formed on the upper surface of the substrate. The further cited regions 171n and 161n are n-type offset regions (e.g., Col. 16:11-21).

The '231 reference thus has no bearing upon the claimed invention and limitations directed to a gate trench with sidewalls and endwalls extending into and insulated from source/drain regions and their respective contact regions. Applicant notes that this is consistent with claim 1, as well as new claims 11 and 12, which further characterize the trench (e.g., as being located within and surrounded on ends and sides by source/drain regions). This is exemplified, for example, by the dashed lines in the cross-section shown in FIG. 2, as further consistent with the top view shown in FIG. 3 from the instant application, both of which are copied below for convenience.

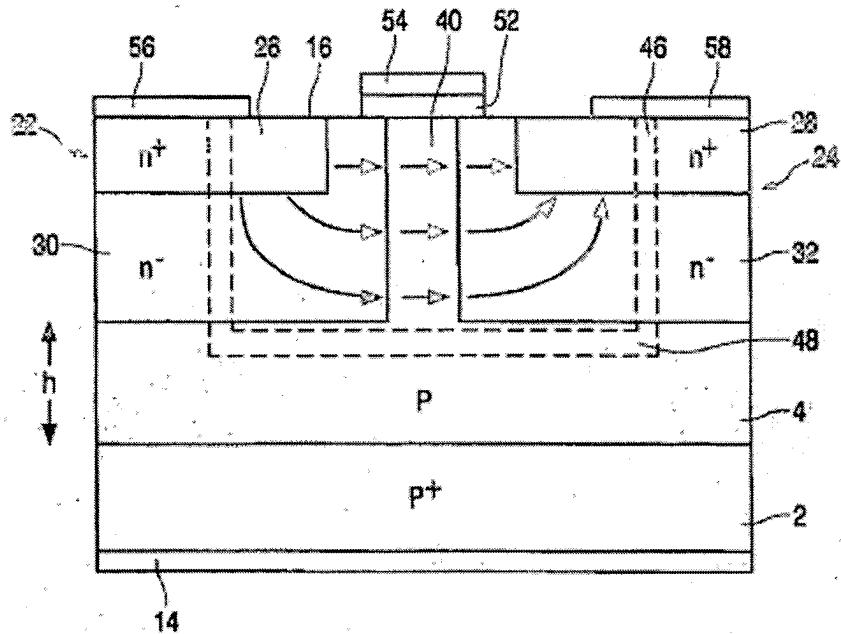


FIG.2

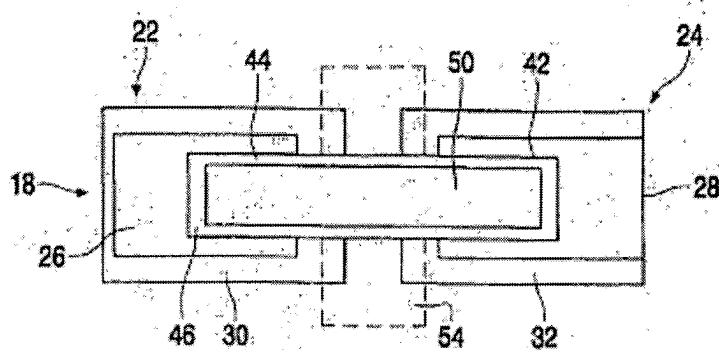


FIG.3

As shown above and consistent with the description in paragraph 0042 of the instant application, the insulated trench 42 extends into each of the source/drain and respective contact regions (30/22, 32/28). As represented by the dashed lines in FIG. 2, the end walls 46 extend into the respective source/drain regions, as do the side walls 42 as shown in FIG. 3. Referring back to FIG. 48B from the '231 reference, none of the cited portions therein provide correspondence to any trench extending into a source/drain region.

In view of the above, the cited '231 reference does not and cannot correspond to the claimed invention as asserted. As all claim rejections rely upon the erroneous interpretation and application of the '231 reference as discussed above in connection with independent claim 1, all rejections (including those of dependent claims 2-10) are improper and should be removed.

Applicant further submits that the § 103(a) rejection of claims 1-3 and 5-10 is improper because the Office Action has improperly applied Section 103(a) and any asserted lack of "criticality" of the claimed depths. Specifically, the Office Action fails to present a *prima facie* case of obviousness before Applicant need show the criticality of a claimed range. *See, e.g.*, M.P.E.P. § 2144.05 ("In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976)"). In this instance, the Examiner has not presented a *prima facie* case of obviousness because the Examiner has not cited to any reference that teaches source and drain implantations which have conductive shallow contact regions as discussed above.

In the Final Office Action, the Examiner fails to present a proper *prima facie* case of obviousness in view of Nakagawa as addressed above. FIG. 2 of the instant application (copied above) as would be well understood in the art, indicates the action of the gate as applied in the trench and respectively with the source and drain regions acts to bias the channel region at depths into the substrate; this affects the operation of the device. For instance, as represented in FIG. 2, the shown arrows of flow extend down along the sidewall of the gate trench to the lower portion of the buried source/drain regions 30 and 32. Absent this trench and related depth, Applicant notes that the bias applied to the gate would appear to be restricted to an upper portion of the channel region (*e.g.*, as shown by the upper line of lateral arrows in FIG. 2). In this context, the Office Action's assertion that no results are obtained by the claimed invention is not only contrary to Applicant's specification, it is also contrary to well-understood characteristics of semiconductor physics.

Applicant further traverses the § 103(a) rejection of claims 1-3 and 5-10 because the proposed modification of the '231 reference would appear to render it inoperable for its intended purpose (*i.e.*, by widening the trench into the respective source/drain regions,

in contrast to FIG. 48B), and because the Office Action has provided no evidence of motivation to modify the '231 reference to include the trench as claimed.

In the Final Office Action, the Examiner alleges that the rejection in view of Nakagawa does not rely on this alleged modification but instead, meets the claim limitations without such a modification (as addressed above).

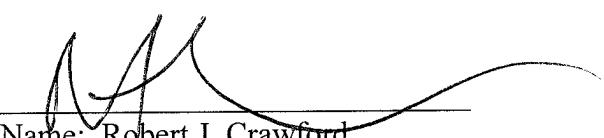
Applicant respectfully traverses the § 103(a) rejection of claim 4 because the cited portions of the '348 reference do not correspond to the claimed invention as discussed above in relation to the § 103(a) rejection of claim 1, in that the respective potential plate regions (and the trench itself) do not extend into the source/drain regions. Moreover, the alleged motivation is misplaced because the proposed modification would render the '348 reference inoperable as claimed (and referenced above), and further because there is no need for such plate regions where the cited trench does not extend as claimed, as consistent with the copied figures above from the instant application and cited reference. Accordingly, Applicant requests that the § 103(a) rejection of claim 4 be withdrawn.

In view of the remarks above, Applicant believes that each of the rejections has been overcome and the application is in condition for allowance. Should there be any remaining issues that could be readily addressed over the telephone, the Examiner is asked to contact the agent overseeing the application file, Peter Zawilski, of NXP Corporation at (408) 474-9063 (or the undersigned).

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